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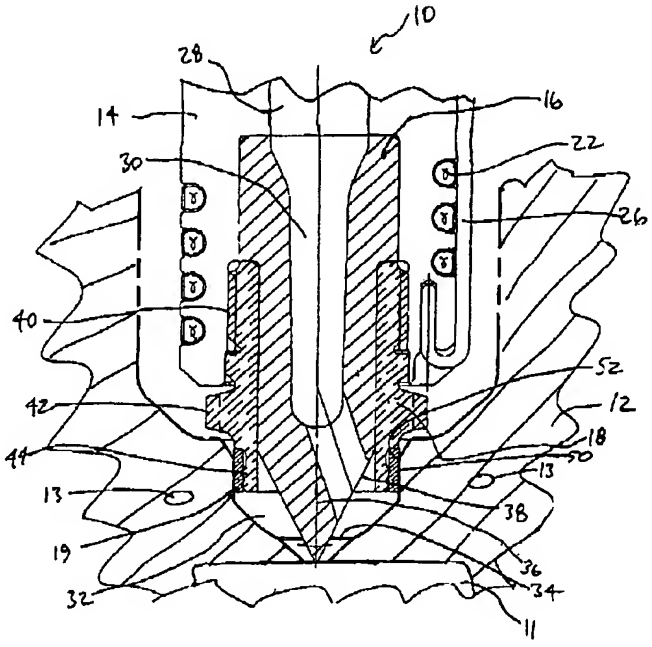
(54) Titre : BUSE D'INJECTION
(54) Title: A NOZZLE



(57) Abrégé/Abstract:
A nozzle for an injection molding machine, having a body, a tip, a tip retainer and a seal piece. The tip is thermally conductive. The tip retainer has a thermal conductivity that is substantially at least the same as that of the tip. The seal piece has a thermal conductivity that is lower than that of the tip. The seal piece seals between the flip retainer and a mold cavity plate.

ABSTRACT

A nozzle for an injection molding machine, having a body, a tip, a tip retainer and a seal piece. The tip is thermally conductive. The tip retainer has a thermal conductivity that is substantially at least the same as that of the tip. The seal piece has a thermal conductivity that is lower than that of the tip. The seal piece seals between the tip retainer and a mold cavity plate.

Title: Nozzle For An Injection Molding Apparatus

FIELD OF THE INVENTION

This invention relates to an injection molding machine, and more particularly to a nozzle tip for a nozzle in an injection molding machine.

BACKGROUND OF THE INVENTION

It is known for a nozzle in hot runner injection molding machines to include a thermally conductive body and a thermally conductive tip. Furthermore, it is known for the nozzle to include a separate tip retainer that joins to the nozzle body and retains the tip in the nozzle body. The tip retainer is also typically used to seal between the nozzle and the mold cavity plate to which the nozzle transfers melt. Because the mold cavity plate is usually cooler than the tip, the tip retainer is typically made from a material that is less thermally conductive than the tip itself.

An example of such a nozzle construction is shown in US Patent No. 5,299,928 (Gellert). By making the tip retainer out of a less thermally conductive material than that of the tip itself, the efficiency of the nozzle to transfer heat from the heater to the melt is reduced, sometimes significantly.

Thus a need exists for new nozzle constructions that have high heat transfer efficiency.

DESCRIPTION OF THE DRAWINGS

For a better understanding of the present invention and to show more clearly how it may be carried into effect, reference will now be made by way of example to the accompanying drawings, showing articles made according to a preferred embodiment of the present invention, in which:

Figure 1 is a sectional view of a portion of a nozzle in accordance with a first embodiment of the present invention; and

Figure 2 is a sectional view of a portion of a nozzle in accordance with a second embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Reference is made to Figure 1, which shows a nozzle 10, in accordance with a first embodiment of the present invention. Nozzle 10 is for transferring melt from a manifold in a hot runner injection molding machine to a mold cavity 11 in a mold cavity plate 12. Mold cavity cooling channels 13 may optionally be included in mold cavity plate 12. Nozzle 10 has a body 14, a tip 16, a nozzle tip retainer 18 and a nozzle seal piece 19. The body 14 includes a heater 22. Body 14 may also include a thermocouple 26. The body 14 has a melt passage 28 that passes therethrough.

The tip 16 may be removable from the body 14, or alternatively may be fixed to body 14. The tip 16 has a melt passage 30 therethrough that communicates with the body melt passage 28. The melt passage 30 may exit from tip 16 into a chamber 32 that surrounds nozzle tip 16. The chamber 32 ends at a gate 34, which opens into the mold cavity 11.

Melt passes from a melt source, through one or more manifold runners, through the nozzle body melt passage 28, through the tip melt passage 30, through the chamber 32, through the gate 34 and finally into mold cavity 11. The centre of the gate 34 defines an axis 36, which is generally parallel to the direction of flow of melt through gate 34, into the mold cavity 11.

The exit from the tip melt passage into the chamber 32 is shown at 38. Exit 38 may be positioned off-centre from axis 36, as shown, or alternatively exit 38 may be concentric with respect to axis 36.

Because the melt flows through tip 16, the tip may be used to heat the melt and is therefore preferably made from a thermally conductive material, so that heat from the heater 22 is transferred to the melt flowing through the melt passage 30. Also, however, because of the melt flow through tip 16, the tip 16 is exposed to a highly abrasive environment, and is therefore also preferably made from a wear resistant material. An example of such a material that meets both these criteria is Tungsten Carbide. The applicant's patent US Patent No. 5,658,604 (Gellert et al.) discloses the construction of a nozzle tip using Tungsten Carbide, and is hereby incorporated by reference.

Because the tip is preferably made from a material such as Tungsten Carbide, it can be relatively difficult to machine a thread on it for removably fastening it to the body 14.

The tip retainer 18 holds the tip 16 in place in the nozzle body 14. The tip retainer 18 is not required to be as wear resistant as the tip 16 because the tip retainer 28 does not have an internal melt passage. Thus, the material of the tip retainer 18 does not have to be as wear resistant as that used for the nozzle tip 16. Accordingly, the tip retainer 18 may be made from a material which is relatively easily machined with threads 40.

The tip retainer 18 may be separable from the tip 16 or may be integrally joined with the tip 16. The tip retainer 18 may, for example, include a threaded portion 40 for mating with a corresponding threaded portion on the nozzle body 14, as shown. Alternatively the tip retainer 18 may include an internal thread to mate with an external thread on the nozzle body 14. Tip retainer 18 may also include a hexagonal gripping portion 42, for receiving a removal tool, so that tip retainer 18 may be removed from nozzle body 14.

The tip retainer 18 may alternatively be brazed to the tip 16. This way, the tip 16 is more easily removable from the body 14 of the nozzle 10, because the tip 16 is assured of being removed from the body 14 when the tip retainer 18 is removed.

The tip retainer 18 is at least in part, positioned between the melt passage 30 and the heater 22 along a significant portion of the length of the melt passage 30. Thus the tip retainer 18 is preferably made from a thermally conductive material, but, as explained above, not necessarily a wear resistant material. The tip retainer may be made from such materials as Be-Cu, Aluminum, Molybdenum or suitable Molybdenum alloys.

A portion of the tip retainer 18 is exposed to the melt. As a result, tip retainer 18 has a sealing surface 44, which is the surface that receives the nozzle seal piece 19.

The nozzle seal piece 19 connects to the tip retainer 18 on the sealing surface 44. The nozzle seal piece 19 seals between the tip retainer 18 and the mold cavity plate 12, to inhibit melt leakage out from chamber 32, and may also serve to align the nozzle 10 in the bore 52 of the mold cavity plate 12. The nozzle seal piece 19 has an outer sealing surface 50 that provides a

seal with the bore 52 of the mold cavity plate 12. This seal may be any suitable kind of seal, such as a mechanical seal. Outer surface 50 may optionally also serve as an alignment means for aligning nozzle 10 into the bore 52 of the mold cavity plate 12. The nozzle seal piece 19 is not positioned between the melt passage 30 and the heater 22, but is rather positioned between the melt passage and the mold cavity plate 12, which is typically cooler than the nozzle tip 16. Thus, the nozzle seal piece 19 is preferably made from a material that is comparatively less thermally conductive than the materials of the nozzle tip 16 and the tip retainer 18. For example, the nozzle seal piece 19 may be made from titanium, H13, stainless steel, mold steel or chrome steel, for example. As another alternative, it may be made from ceramic. Other suitable materials for the seal piece 19 are disclosed in US Patent No. 5,879,727 (Puri) , which is hereby incorporated by reference.. Puri discloses such materials for use as an insulative layer for a nozzle.

The seal piece 19 may be a separate piece that is mechanically joined to tip retainer 18 by a suitable joint, such as an interference fit, as shown. Alternatively, the seal piece 19 may be made by spraying a coating onto the tip retainer 18, and then machining the coating down as required, to a suitable dimension for mating and sealing appropriately with mold cavity plate 12. US Patent No. 5,569,475 (Adas et al.) discloses the method of spraying on an insulating layer onto a portion of a nozzle, and is hereby incorporated by reference.

Reference is now made to Figure 2, which shows a nozzle 100 that includes a tip 102. Tip 102 differs from tip 16 in that tip 102 has a melt passage 104 with an exit 106 that is concentric about the axis 26 of the gate 34.

Thus, a nozzle in accordance with the present invention may have a tip that inserts into the gate 34 and has an off-centre melt passage exit, or alternatively has a tip that has a concentric melt passage exit.

While the above description constitutes the preferred embodiments, it will be appreciated that the present invention is susceptible to modification and change without departing from the fair meaning of the accompanying claims.

CLAIMS:

1. A nozzle for an injection molding machine, comprising:

a nozzle body with a body melt passage therethrough;

a nozzle tip with a tip melt passage therethrough, said tip connected to said body, said tip melt passage in communication with and downstream from the body melt passage, the tip being made from a thermally conductive material;

a tip retainer for retaining said tip on said body, the tip retainer being made from a thermally conductive material; and

a seal piece located adjacent the downstream end of said tip retainer for sealing against melt flow between said tip retainer and a mold cavity plate, said seal piece being made from a relatively less thermally conductive material.

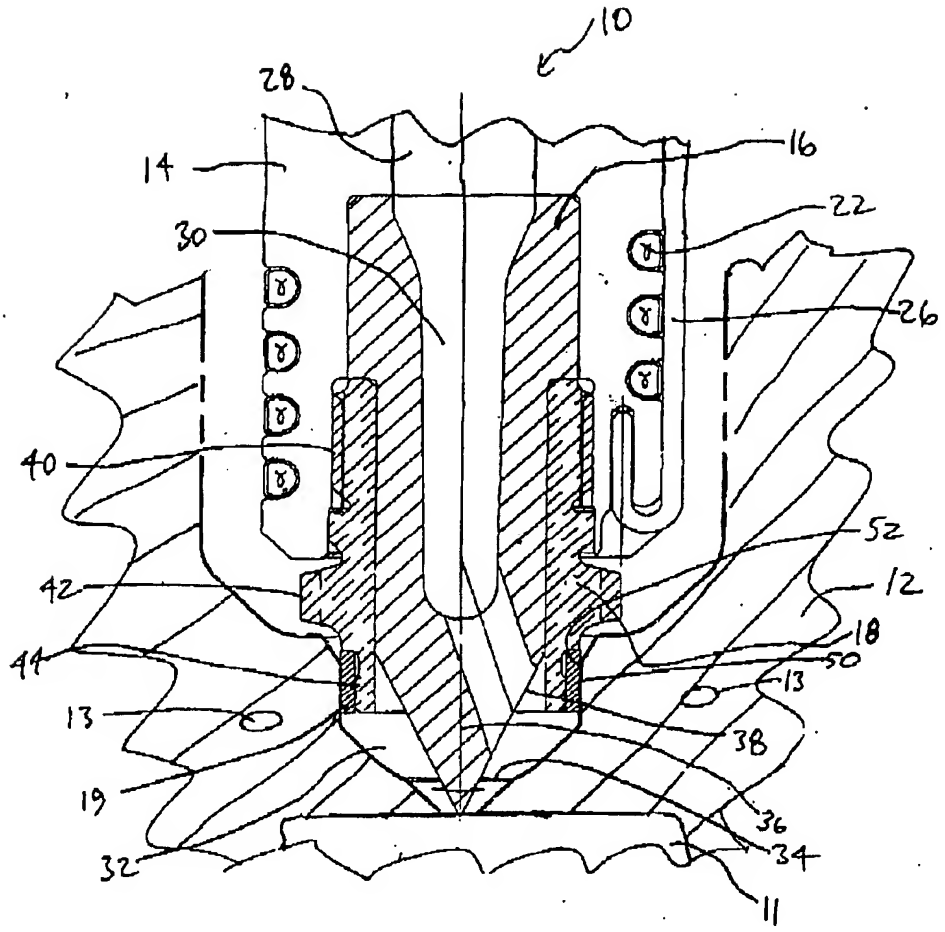


FIGURE 1

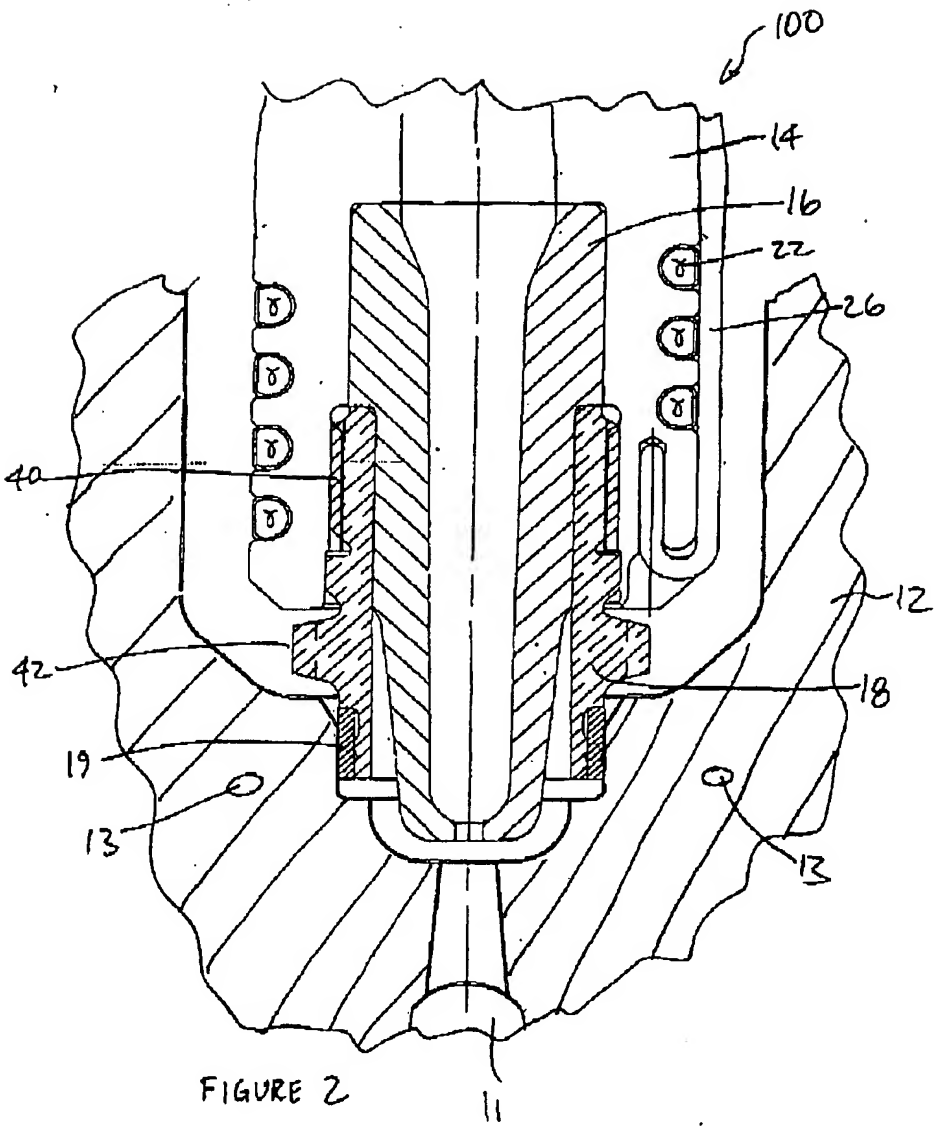


FIGURE 2

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